DOCUMENT RESUME

ED 383 397 JC 950 324

AUTHOR Cunningham, Pearley
TITLE A Survey of Computer Use in Associate Degree Programs in Engineering Technology.
PUB DATE Jun 95
NOTE 58p.; Ed.D. Practicum, Nova Southeastern University.
PUB TYPE Reports - Research/Technical (143) -- Tests/Evaluation Instruments (160)

EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS Community Colleges; *Computer Assisted Design; Computer Centers; *Computer Networks; *Computer Software; *Computer Uses in Education; *Engineering Education; Programming Languages; Technical Education; Two Year Colleges; Use Studies
IDENTIFIERS Internet

ABSTRACT

As part of its annual program review process, the Department of Engineering Technology at the Community College of Allegheny County, in Pennsylvania, conducted a study of computer usage in community college engineering technology programs across the nation. Specifically, the study sought to determine the types of software, Internet access, average student to personal computer (PC) ratio, and computer language education available at each program. The study also determined if the program was accredited by the Accreditation Board for Engineering and Technology (ABET). Questionnaires were mailed to 103 Engineering Technology departments, receiving a response rate of 38.8% (n=40). Study results included the following: (1) 27 colleges had at least one ABET accredited program; (2) on average, respondents indicated that 28% of students owned PC's; (3) the 12 departments that had Macintoshes also had IBM-based PC's (IBM-PC's); (4) while 30% of students had access to Macintosh PC's, 95% of students had access to IBM-PC's; (5) colleges had an average full-time student/PC ratio of 4.3; (6) all but one school reported a course in the department to provide computer skills; (7) 59% of computers were networked; (8) 8 schools provided student Internet accounts, while 9 had no Internet connection at all; (9) the most frequently required languages were BASIC, Assembly, and C; and (10) the most popular programs included Autocad, WordPerfect, Mathcad, pSpice, Lotus, and Excel. Seven appendixes include the survey design guide, the computer use questionnaire and a list of schools contacted. (MAB)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED 383 397

A SURVEY OF COMPUTER USE IN ASSOCIATE DEGREE PROGRAMS IN ENGINEERING TECHNOLOGY

Emergence of Vocational, Technical, and Occupational Education in America

Pearley Cunningham
Community College of Allegheny County

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
P. Cunningham
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
☑ This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

Toni L'Hommedieu
Western Pennsylvania

A practicum report presented to Programs for Higher Education in partial fulfillment of the requirements for the degree of Doctor of Education

Nova Southeastern University
Revised June, 1995

JC 950 324

BEST COPY AVAILABLE

Abstract of a practicum report presented to Nova Southeastern University in partial fulfillment of the requirements for the degree of Doctor of Education

A SURVEY OF COMPUTER USE IN ASSOCIATE DEGREE PROGRAMS IN ENGINEERING TECHNOLOGY

by

Pearley Cunningham

Revised June, 1995

One problem in assessing programs in engineering technology is the lack of information available in the literature on the use of computer use by these programs. The purpose of this study was to conduct a survey and determine the use of computers and related software in engineering technology. The research question was "To what extent are colleges using computers and computer software in their engineering technology programs?" The research procedure began with a review of the literature. This review suggested that information was needed related to (a) the types of software, (b) access to the Internet, (c) the average student to computer ratio, and (d) computer languages

used in the engineering technology programs. A questionnaire was constructed and mailed to 103 schools with a 39% return.

The results of the study provided information on software use, languages, and department and discipline enrollment statistics. The conclusion of the study was that the programs in engineering technology have made good use of the personal computer. The most popular programs were Autocad, WordPerfect, Mathcad, pSpice, and Lotus or Excel. BASIC is the most popular computer language.

Recommendations were made to the Head of the Department of Engineering Technology to add WordPerfect to the program, to develop a plan for Internet access, and to research what software is being used at local transfer institutions. A recommendation was made for the electronics faculty to adopt the pSpice program. A final recommendation was made to disseminate the survey results through ERIC.

TABLE OF CONTENTS

Page

LIST OF TABLES 7

Chapter

1. INTRODUCTION 8

Background 8

Purpose of the Study 8

Significance to the Institution 8

Relationship to Emergence of Vocational, Technical, and Occupational Education in America 9

Research Question 10

Definition of Terms 10

2. REVIEW OF THE LITERATURE 12

Need for Telecommunications 12

Languages and Specialized Applications 14

Indications of Current Use of Computers . . . 15

Summary 16

3. METHODOLOGY AND PROCEDURES 17

Problem Solving Methodology 17

Data Collection 17

Assumptions 22

Limitations 22

TABLE OF CONTENTS (cont.)

Page

4. RESULTS 23
Returned Questionnaires 23
Enrollment Information 23
Computer Availability 26
Development of Student Computer Skills 27
Networks and the Internet 28
Computer Languages and Applications 29
Use of Computer Application Software 30
5. DISCUSSION, CONCLUSIONS, IMPLICATIONS,
AND RECOMMENDATIONS 34
Discussion 34
Conclusions 38
Implications 39
Recommendations 41
REFERENCES 43
APPENDIXES 45
A. Program Review Process 46
B. Survey Design Guide 47
C. Computer Use Questionnaire 48
D. Cover Letter 50
E. Envelope Design 51

TABLE OF CONTENTS (cont.)

Page

F. List of Schools 52

G. Access Database Input Screen 56

LIST OF TABLES

Table Page

1. Program Enrollment by Discipline 24
2. Average Number of Students per Discipline 25
3. Types of Computers on Campus 27
4. Access to the Internet by Engineering Technology Programs 29
5. Languages Offered by Engineering Technology Programs 30
6. Computer Aided Drafting and Design Software 31
7. Electronic Analysis and Simulation Software 32
8. Mathematics Analysis Software 33

Chapter 1

INTRODUCTION

Background

The Community College of Allegheny County has instituted a new annual Program Review Process. Within that review (Appendix A) the department must assess its facilities and project major equipment needs. The department has invested considerable financial resources to increase the use of computers in the engineering technology courses. This has been done with the belief that other schools are also increasing their use of computers. However, little concrete information is available to support this position. To adequately complete the review, the department needed direct information on how computers were being applied by other departments of engineering technology at other colleges.

Purpose of the Study

The purpose of this study was to conduct a survey of colleges to determine the use of computers and related software in engineering technology programs.

Significance to the Institution

The Department of Engineering Technology at the Community College of Allegheny County, South Campus, is

participating in a new Program Review Process. As part of that process, the Department Head desires to report on the use of computers in the engineering technology department relative to the activities of other schools. The department has concentrated both its financial and personnel resources to increase computer use in the engineering technology program over the past three years. Information gathered from this survey will allow the department to compare the use of computers at South Campus with comparable schools. From this comparison recommendations for changes in curriculum or equipment can be made as required by the Program Review Process.

Relationship to Emergence of Vocational, Technical, and Vocational Education in America Seminar

In the seminar Emergence of Vocational Technical and Occupational Education in America the impact of the computer on changing the skills required for modern industry was discussed. Drafting has moved from the triangle and t-square to the mouse and workstation. In electronics, the computer is used to simulate circuits before they are constructed. "In engineering, high technology could be defined as any influence of the computer on (1) engineering and design, . . . (3)

fabrication and assembly . . . "(Groff, 1989:30). Most programs in engineering technology describe themselves as teaching high technology skills. This project will examine the extent to which colleges are applying the computer in engineering technology courses.

Research Question

The research question is, "To what extent are colleges using computers and computer software in their engineering technology programs?"

Definition of Terms

The following terms have specific definitions as used in this study:

1. Accreditation Board for Engineering and Technology (ABET) is the group responsible for certifying the quality of engineering technology programs as part of the professional registry process.
2. Computer aided drafting (CAD or CADD) is the generic descriptive title for computer programs that produce both two and three dimensional drawings.
3. Internet is a term for the world wide computer network used by college, government, and commercial institutions for communications and data exchange.
4. Macintosh (MAC) is the computer type manufactured by

Apple Computer Company and using a proprietary operating system.

5. Personal Computer (PC) is the computer type manufactured by several companies and using an operating system by Microsoft.

6. Program Review Process is a new procedure at the Community College of Allegheny County for yearly evaluation of programs and disciplines based on data and research information.

7. Student to computer ratio is a calculation based on the number of computers within a program area and the number of students in the program.

Chapter 2

REVIEW OF LITERATURE

Need for Telecommunications

In Dateline 2000, Parnell describes the technology revolution in industry as moving from ". . . the cow chip to the potato chip to the silicon chip . . ." (Parnell, 1990, p. 230). In his book he predicts that schools will increase their use of telecommunication and interactive media. As schools require entering students to have computers, the computer will be fully integrated into the curriculum.

Among the increased uses of computer technology by business and industry is telecommunications. As networks, electronic mail, and the Internet are being applied in today's industrial environment, Fruchter of the Center for Integrated Facility Engineering at Stanford University calls for engineering students to develop skills in these communications technologies as well as computer aided drafting and design (Joyner, 1995). Much of the demand for the increased ability with computer technology is coming from changes in industry. The report Partners in Progress calls for increased access of two-year colleges to electronic communication (Forman and Stith, 1992). A recent

survey, by the Center for Scholarly Technology, found that of 995 two-year and four-year colleges, two-thirds have Internet access. Additionally, both student and faculty ownership has increased (Syllabus, 1993). A local survey of the region served by the South Campus of the Community College of Allegheny County revealed that 52% of the companies planned to invest in computer based equipment such as computer aided drafting and computer numerical control (Cunningham and Sandrock, 1991). Technology is changing so rapidly in some fields that continuous education will be necessary. As Joel Orr an editor for McGraw-Hill Publishing states "... the electrical engineering degree becomes obsolete within 18 months of its award" (Reid, 1995,p. 20). Colleges need to use the Internet to assist in training students to train themselves in the changes in technology (Reid, 1995). Schools are being pressured from multiple sources to provide technical training for their students. "The mission of academic institutions to prepare students for life and for their careers, requires that educators incorporate technology into teaching and learning in most, if not all, courses" (Bailey and Cotlar, 1994, p. 185).

Languages and Specialized Applications

In addition to networks, the more common uses of microcomputers such as word processing and spreadsheets are important to the engineering and technology worker for report preparation and communication. For the student to achieve a consistent level of expertise, the technical faculty may need to provide prerequisite courses (Thomas, 1991). In the engineering technologies the need for specialized accreditation places added need for incorporation of computer technologies. The 1991 guidelines from the Accreditation Board for Engineering and Technology specify that education in one or more languages must be included in the curriculum and that computer applications be included in the technical courses.

The colleges have responded to the need for increased computer training in a variety of ways. In the area of computer languages, Hata (1986) found that the BASIC language was the most popularly used language in engineering technology programs, but that schools were switching to Pascal and C.

Many of the two year engineering technology programs have an emphasis on computer aided drafting (CAD) and applications software with AutoCAD being most

often mentioned (Gourley, 1990), (Eisenberg, 1987). With the increased use of CAD in engineering technology programs, the need for standards arose. The Foundation for Industrial Modernization (1994) has published a list of National Skill Standards for CADD programs which includes computer skills needed by students, hardware needed, and the call for each student to work at an individual workstation. This is a one-to-one student per computer ratio.

Indications of Current Use of Computers

In studying PC use by engineering programs at the university, Huelsman (1991) found that although large numbers of computers were available, they are not heavily used in engineering courses. Further, the use of PCs in colleges and universities was behind their use in industry. In the area of electrical engineering, 25% of the students have their own computer. Also 45%of the engineering students receive their computer training in an engineering department course, while another 45% of the students report learning their skills on their own. The average ratio of student access was 3.47 students to computer (Huelsman, 1991). These statistics apply to the university engineering programs, but no information was

obtained relative to engineering technology.

Summary

According to Bailey and Cotlar all college programs should be using the newer computer technologies. However, in engineering technology the demands of industrial cooperation and rapid changes in technology have intensified the need. Technical programs need to provide training in the use of word processing, spreadsheets, languages, computer aided drafting, and additional specialized applications. Although a good bit is known about the use of computers at the university level, such as departmental courses and student to computer ratio, less information is available on the two-year engineering technology programs. This practicum supplements the available information on the use of computers, hardware, languages, and applications in two-year engineering technology programs.

Chapter 3

METHODOLOGY AND PROCEDURES

Problem Solving Methodology

The research methodology used in this practicum was a descriptive study. The study determined the extent to which personal computers and software were used by community colleges in associate degree programs in engineering technology.

Data Collection

Questionnaire Design

The procedure began with a review of the relevant literature on the use of computers in engineering technology. The literature review did not produce a clear picture of computer use in two-year engineering technology programs. It was decided to survey the two-year schools known to have engineering technology programs. The techniques developed in the Applied Educational Research Seminar were followed. Appendix B contains a check list developed in the seminar that was used to guide this survey. Using the information from the literature review and discussion with members of the Department of Engineering Technology, a set of objectives for the study was developed. A meeting with the Head of the Department of Engineering Technology

resulted in the following objectives:

1. The study will determine the types of software used by associate degree programs of engineering technology.

2. The study will determine the access to the Internet of students and faculty in associate degree engineering technology programs.

3. The study will determine the average student to computer ratio for associate degree engineering technology programs.

4. The study will determine the computer languages used and the depth of coverage required by associate degree engineering technology programs.

Based on these objectives, a questionnaire was designed to collect information in support of these objectives. Where possible, closed-ended questions were used. This was to allow respondents to finish the form quickly. This format also allowed easier grouping and presentation of the results. The questionnaire was reviewed by all members of the Department of Engineering Technology and the divisional dean. In addition, an instructor in the English Department reviewed and commented ont he questionnaire. Based on these comments, the questionnaire was revised. The

final version is in Appendix C. The department head also agreed, at this time, to allow the department to cover of the expense of printing and mailing of the survey.

To encourage faculty to complete and return the questionnaire, a cover letter was included explaining the purpose of the study and offering to return feedback on the results. The physical form of the questionnaire was a four page booklet. The front page contained the cover letter. The inside two pages contained the questionnaire. By folding the back page, it formed a pre-stamped return envelope. In Appendix D is a copy of the cover letter, while Appendix E shows the envelope side of the booklet.

School Sample

The next step was to develop a mailing list of schools to survey. It was determined to be economically impractical to send the questionnaire to the over 1200 community colleges in the United States. Since the American Society for Engineering Education yearly surveys the number of graduates in engineering and engineering technology, this list of schools was used as a base. From this list the associate degree schools were identified and were placed on the final

mailing list. To assure good local representation, schools in Pennsylvania and surrounding states were added to the list. The street addresses were located by referring to a list of all community colleges from the Executive Dean's office. The result was a list of 103 schools shown in Appendix F.

Data Collection and Analysis

The questionnaire was sent to each school to the attention of the Chair of the Department of Engineering Technology. At the suggestion of the department head and the dean rather than send a reminder card, a post card was included with the questionnaire. By returning the card the respondent could receive a summary of the survey. It was felt this would provide incentive to the respondents to complete and return the questionnaire. The surveys were mailed at the end of December to allow reception by the faculty when they returned from Christmas vacation. A total of six weeks was allowed for receipt of the questionnaires. It was decided that a second mailing would not produce enough additional respondents to justify the expense ($1.20/questionnaire). This decision limited the number of responses.

As the questionnaires were received the

information was entered into a microcomputer database. The database program used was Microsoft Access. It was selected for its ease of use and Windows type interface. The input screens used are shown in Appendix G. A mailing list was also established of respondents desiring a summary of the survey results.

To analyze the collected information, several forms were prepared in the Access database to organize the information into tables. The enrollment information was transferred to a spreadsheet for calculations. The information was grouped into a series of descriptive headings related to program enrollment, computer availability and skills development, networks, languages and applications. From these broad categories the responses to the objectives of the study were developed, including implications to the local situation and recommendations for change.

The survey results were mailed to those respondents requesting a copy. The complete report, with recommendations, was given to the Head of the Department of Engineering Technology and the Dean of the Division of Science, Mathematics and Technology.

Assumptions

It was assumed that (a) the department chairperson was the correct person to provide the information on computer usage; (b) the schools would share the information; (c) the schools on the list were representative of all associate degree programs in engineering technology.

Limitations

Since the mailing list was developed from a list of schools willing to report their enrollment figures to the American Society of Engineering Education, they may represent a more open attitude than all schools. Not all schools on the list responded to the questionnaire. If the lack of response is because they didn't see the computer question as important, or did not wish to disclose their lack of resources, the results of this survey would not fairly describe the use of computers in engineering technology. Also the majority of the schools on the list, and the majority of respondents to the survey, had formal accreditation by the Accreditation Board for Engineering and Technology (ABET). Since ABET guidelines require computer use in the programs, the results may be skewed to heavier use.

Chapter 4

RESULTS

Returned Questionnaires

A total of 103 questionnaires were mailed. The cover letter was addressed to the Department Head of Engineering Technology. Responses came from a mixture of department types. Some responses received represented multiple areas of engineering technology, others only specific sub-disciplines, such as civil engineering. A total of 40 schools responded for a return rate of 38.8%. Of the 40 schools 27 have at least one program with ABET accreditation.

Enrollment Information

Schools were requested to respond with their enrollment information. In table one the results of that information is presented. The largest single program, both full and part-time, was Electrical Engineering Technology. The category of Other Technology represents a variety of programs related to engineering technology such as drafting, building construction, or air conditioning. The total number of students covered by the survey was 11,705. Of this number 61% were enrolled as full-time students and 39% were enrolled as part-time students. If both full and

Table 1

Program Enrollment by Discipline

Discipline	Full Time	Part Time	Total
1. Electrical Engineering Technology	2,507	1,586	4,093
2. Mechanical Engineering Technology	902	722	1,684
3. Civil Engineering Technology	769	219	988
4. Manufacturing Engineering Technology	92	121	213
5. Industrial Engineering Technology	151	232	383
6. Other Technology	2,652	1,692	4,344
7. Total Enrollment	7,133	4,572	11,705
8. Percent of Total	61	39	100

part-time students were included, the average department enrollment is 293 students. The relative

average size of each program is shown in Table 2. This

Table 2

Average Number of Students per Discipline

Discipline	FT	NFT	PT	NPT
1. Electrical Engineering Technology	74	34	57	28
2. Mechanical Engineering Technology	44	22	42	17
3. Civil Engineering Technology	51	15	18	12
4. Manufacturing Engineering Technology	10	9	15	8
5. Industrial Engineering Technology	19	8	26	9
6. Other Technology	95	28	77	22

Note. FT = average full-time enrollment, PT = average part-time enrollment, NFT = number of schools responding in full-time category, NPT = number of schools responding in part-time category.

table is adjusted to reflect only those schools responding with enrollment in each subject area. For example, Electrical Engineering Technology was the most often reported program with 34 schools reporting full time enrollment yielding an average of 74 full time students. Part-time enrollment was reported in 28 schools for an average of 57 part-time students in Electrical Engineering Technology.

Computer Availability

Each respondent was ask to indicate their impression of the number of students in their program owning a personal computer. This response ranged from 3% to 75% with an average of 28%.

The types of computers provided by the schools in laboratories and computer centers were divided into two types. The personal computer, or PC, and the Macintosh, or MAC. In Table Three the number of PC systems and MAC systems held by departments and the college at-large is presented. No department had only MAC computers. The 12 departments with MAC computers also had PC computers. One school reported no computer data.

One criteria used to measure computer access was the student to computer ratio. For this study, a ratio

of 4.3 full time students per department PC was found. Also 95% of the students had access to PC type computers and 30% had access to MAC computers.

Table 3

Types of Computers on Campus

Computer	DC	ND	CC	NC
PC	44	38	247	38
MAC	10	12	24	21

Note. DC = average number of computers per department, ND = Number of departments responding, CC = average number of computers college wide at each school, NC = number of colleges responding.

Development of Student Computer Skills

As the computer becomes more available in the two-year college program, development of student skills becomes an issue. All but one school reported a course in the engineering technology department to provide 62% of the students with their computer skills. Only 17% of the students acquired the necessary skills in a general college course. Some students (15%) entered

the college with prior skills, and 13% of the students acquired the necessary skills by self study. The schools reported that at least half of the courses required the use of the computer.

Networks and the Internet

The schools surveyed report a variety of levels of application of locally based computer networks. Of the 40 schools, eight have no networks installed. Of the schools reporting networks, 59% of the computers available were networked. The Novell system was used in 53% of the networks.

In addition to local networks, the questionnaire requested information on the access of faculty and students to the Internet. Table four summarizes those responses. Of the 40 schools nine reported no Internet access of any kind. The faculty at 25 of the schools had individual access to the Internet. Eight of the schools provided individual student Internet accounts, and in 16 schools the library provided a point of access to the Internet. Of these 16 schools, only two also had student accounts. Four of these schools had only the library accounts available.

Table 4

Access to the Internet by Engineering Technology Programs

Type of Access	Number of Schools	Percent of Total
None	9	23
Department	5	13
Library	16	40
Student	8	20
Faculty	25	63
Faculty and Student	6	15

Computer Languages and Applications

In Table Five a summary of the use of computer languages is presented. The table lists the most common languages offered in two-year colleges, and if the language was required or suggested in at least one program in the department. The most frequently required language was BASIC, followed by Assembly, and C.

Table 5

Languages Offered by Engineering Technology Programs

Computer Language	Number of Schools Requiring Language	Number of Schools Suggesting Language
BASIC	25	2
Pascal	4	4
Fortran	3	3
C	8	7
Assembly	20	3
Cobol	0	0

Use of Computer Application Software

The use of industrially popular application software in teaching students was explored by the questionnaire. In addition to the use of such productivity software as word processing, information on the use of computer based drafting, electronic circuit simulation, and mathematics was obtained.

Word Processing Software

Use of word processing was reported by 38 of the schools with 34 reporting the use of the WordPerfect program. Microsoft Word was used by 18 schools, and 14 of these schools reported using both programs.

Computer Aided Drafting and Design Software

Drafting is very important to the engineering technology curriculum. In recent years the use of CAD software has changed the field of drafting. The most popular CAD software program reported by the schools was Autocad (Table 6). All of the schools, reporting the use of CAD, reported using this program. For those schools reporting multiple packages, it was not possible, with this questionnaire, to determine which program was dominate.

Table 6

Computer Aided Drafting and Design Software

Program	Number of Schools
Autocad	38
Microstation	10
Versacad	5

Electronic Simulation Software

In Electrical Engineering Technology the use of computer simulation is an increasing trend. To determine how many schools were involved with teaching these newer techniques, the questionnaire requested a check off on usage of the most popular of the programs. From Table 7 the popularity of the pSpice program may be seen. The pSpice program was used by 22 of the 34 Electrical Engineering Technology programs reported in the survey.

Table 7

Electronic Analysis and Simulation Software

Software Program	Number of Schools
Logic Works	1
Microcap III	7
pSpice	22
Electronic Workbench	9

Mathematical Analysis Software

There were two different types of mathematics software about which the schools were ask to provide

information. Table 8 represents the summary of what mathematical software was used. The spreadsheet programs Lotus 123 and Excel were used about equally. The more elaborate algebraic programs represented by Derive, Mathcad, Matlab and Mathematica were used less. But of this group, Mathcad was the leading software program in use in the engineering technology programs. Additionally, 15 of the 17 Mathcad schools also use one or both of the spreadsheet programs.

Table 8

Mathematics Analysis Software

Software Program	Number of Schools
Lotus 123	23
Excel	20
Derive	6
Mathcad	17
Matlab	4
Mathematica	2

Chapter 5

DISCUSSION, CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

Discussion

This study began with a series of four objectives. These objectives and other broad observations will be discussed in terms of the results of the survey.

Discussion of Study objectives

Objective One

The first objective of the study was to determine the types of software used in the associate degree engineering technology programs. A popular use of the personal computer is word processing. This was found to be true of the engineering technology programs. The use of two specific programs were surveyed, WordPerfect and Word. Although some schools used both programs, the majority of the schools were using WordPerfect.

CAD. Gourley (1990) and Eisenberg (1987) found that Autocad was the most commonly used computer aided drafting and design program in the two-year colleges. This study also found Autocad to be the leading program. Although some colleges reported more than one program, all the schools using any CAD were using Autocad.

Mathematics Programs. The call in the literature for inclusion of computer applications is being met through the use of spreadsheets and computer-based algebra programs. The spreadsheet programs, Lotus 123 and Excel, were equally popular and used by over half of the schools. Many departments are also using one of the newer computer-based algebra programs. The Mathcad program was the most widely adopted program.

Electronic Simulation Software. In Electrical Engineering Technology, computer aided design of electronic circuits has become a common application. The use of four different packages was considered. The program pSpice was used by the largest number of schools.

Objective Two

The second objective of the study was to determine the use of networking and the Internet by the two-year colleges.

Networks. Only 8 of the 40 schools surveyed had no networks installed. As Parnell (1990) predicted the engineering technology programs are moving to increased use of telecommunications. On the average 59% of the computers reported in this survey were networked in some way. This trend supports the call for increased

use of electronic communications technology by Joyner (1995) and by Partners in Progress (Forman and Stith, 1992).

Internet Access. Although the schools are making use of local networks, few have adopted wide access to the Internet. Faculty at 25 of the 40 schools had access to individual accounts on the Internet, but only 8 of the 40 schools provided individual student accounts. The findings of the Center for Scholarly Technology (Syllabus, 1993) that two-thirds of the colleges had Internet access applies in only limited aspects at the two-year college.

Objective Three

What is the student to computer ratio? The student to computer ratio for associate degree engineering technology programs was not available in the literature. Huelsman (1991) found that for university engineering departments this ratio was 3.47 students per computer. In this survey the ratio of full time students to personal computers was 4.3 students per computer.

Objective Four

What computer languages are being used in the associate degree programs? Hata (1986) suggested that

schools were switching from BASIC to Pascal and C. However, this survey found BASIC still a clear leader with 25 of the 40 schools requiring the language in their programs. C was required by only eight schools and Pascal by only four schools. In addition to BASIC, assembly language was required by many schools.

Computer Availability and Use

The survey by the Center for Scholarly Technology (Syllabus, 1993) found that student ownership of personal computers was increasing and Huelsman (1991) found 25% of electrical engineering students have their own computers. This study would support that finding with 28% of the engineering technology students having their own computer. Although ownership was about the same as at the university, to acquire the needed computer skills, two-year students depend more on department level courses, 62%, than the university engineering students, 45% (Huelsman, 1991). Also only 13% of two-year students acquire their skills on their own compared to 45% at the university. Huelsman also stated that the large numbers of computers available to the engineering programs were not being utilized by very many courses, but this study found the computer being applied in 10 of the 20 course required for the

associate degree in engineering technology.

Conclusion

The purpose of this study was to determine the use of computers and related software in engineering technology programs. From this study it can be concluded that the associate degree programs in engineering technology have made good use of the personal computer in educating students. The primary type of computer being used is the PC system.

Computer Applications

The majority of schools have provided students with access to the local networks and have used many of the popular software packages. The student to computer ratio was higher at the two-year college than at the universities. Even so, the two-year colleges were using the computer in half of their courses. The adoption of Autocad by all of the schools would suggest a commitment of the computer resources to the CAD program. The study found that the leading applications used by associate degree engineering technology programs were WordPerfect for word processing; Autocad for computer aided drafting; Mathcad for algebra based work; and either Lotus or Excel. The program pSpice was the clear leader in electronic simulation software.

Languages

The primary language was BASIC. The use of other languages is small. Any trends seen by Hata in 1986 for Pascal or C to replace BASIC have not continued. Assembly language was required by half the schools. This language is important to Electrical Engineering Technology. The large number of those programs responding to the survey would account for the strong support for assembly language.

Networks

In the literature student access to the Internet is deemed important. Reid (1995) called for the use of Internet training as a means of keeping up with the change to a more information driven society. With only 8 of the 40 schools providing student accounts, the two year schools are not meeting that call. The schools have the necessary infrastructure with 59% of the computers in engineering technology departments networked. The schools could extend those local networks as a connection point to the Internet.

Implications

One motivation for this study was to provide information for the program review process. Since the schools represented by the survey are similar in size

to South Campus, the survey results have implications to the local programs. The implications of this survey for the Department of Engineering Technology at South Campus cover four major areas.

Computer Availability and Use

It would seem that the belief expressed in Chapter One, that other schools are increasing their computer use is true. Considerable financial resources have been committed to acquiring computers for the engineering technology laboratories. This has resulted in the student to computer ratio for the engineering technology program at South Campus being lower than the survey average. On this measure the college is doing well, and no additional computers should be needed at this time.

Networks

Although all of the computers in the department are networked, no training on the Internet is available. The implication for South Campus students is that without training in Internet use, they may be at a disadvantage.

Computer Applications Software

At South Campus, students currently use three of the major applications, Autocad, Mathcad, and Excel.

For word processing, the Microsoft Word program is used instead of the more popular WordPerfect. The implication of this study is that the department should consider providing access to WordPerfect.

Electronic Simulation Software

This study implies that pSpice is the most popular of the four simulation programs considered. This program is included at no charge in many textbooks and may account for its popularity. In the Electronic Engineering Technology program the department had considered changing form Microcap III to pSpice as a less expensive alternative. However, without the information of this survey the department was reluctant to change. The implication of this study is that by adopting pSpice the department would be among the majority of schools.

Recommendations

The implications of this study suggest that the associate degree programs in engineering technology are actively using the computer. These recommendations are intended to further the use of computers both locally and in the larger engineering technology education community.

Recommendation 1. The electronics faculty at South

Campus should adopt the pSpice program for electronic simulation by phasing in adoption over a two year period.

Recommendation 2. The Head of the Department of Engineering Technology should purchase a reasonable number of copies of the WordPerfect program for installation on the department network.

Recommendation 3. The Head of the Department of Engineering Technology and the campus Director of Computer Services should meet and develop a process to connect the department network to the Internet by the 1996-97 school year.

Recommendation 4. Additional research should be conducted by the Head of the Department of Engineering Technology to determine if the software being used by the local transfer institutions is the same as the software being used by the community colleges.

Recommendation 5. The results of the survey be disseminated to the wider engineering technology community. This will be done by mailing copies of the report to those respondents who provided their address and by submitting a copy to ERIC.

REFERENCES

Accediting Board for Engineering and Technology. (1991). Criteria for accrediting programs in engineering technology. New York, NY:Author.

Bailey, E. K. and M. Cotlar (1994, April). Teaching via the Internet. Communication Education, 43, (2), pp. 184-193.

Cunningham, P. and B. Sandrock (1991). Mid-mon valley survey:Education and training needs. (ERIC Document Reproduction Service No. ED 356 828)

Eisenberg, E. R. (April/May, 1987). Characteristics of highly rated associate degree programs. Engineering Education, pp. 735-740.

Forman, S. and J. Stith (1992). Partners in Progress. Washington, D. C.: National Science Foundation.

Foundation for Industrial Modernization. (1994). National occupation Skills Standards; Computer aided drafting and design. Washington, D. C.:Author.

Gourley, F. A. (1990, April). Two-year ET programs:Essential topics and levels of proficiency. Engineering Education, pp. 426-430.

Groff, W. H. (1989). Emergence of vocational, technical and occupational education in America. Ft. Lauderdale, FL: Program for Higher Education, Nova [Southeastern] University.

Hata, D. M. (May, 1986). The impact of software on associate degree programs in electronic engineering technology. Engineering Education, pp. 738-741.

Huelsman, L. P. (May, 1991). Personal computer in electrical and computer engineering: Education survey. IEEE Transactions on Education, 34, (2), pp. 175-178.

Joyner, G. (Spring, 1995). Meeting the oldest challenge in the engineering discipline. Education by Design, p. 5.

Parnell, D. (1990). Dateline 2000. Washington, D. C.: Community College Press, American Association of Community and Junior Colleges.

Reid, G. (1995, April/May). Mapping the route to the new millennium. Community College Journal, pp. 426-430.

Staff (1993, November/December). 1993 USC survey released. Syllabus, pp. 24-25.

Thomas, C. R. (1991, September). The need for department policies regarding student computer usage in engineering and technology. Proceedings of the Conference on Frontiers in Education (pp. 38-40). West Lafayette, IN: American Society for Engineering Education.

APPENDIXES

Appendix A

Program Review Process

Assessment of Program and Discipline Resources

The department head with support of the department will annually prepare a report and submit to Division Dean of Instruction by February 1 to assess program and discipline resources. The assessment of program and discipline resources requires data drawn from a variety of sources. these include:

Staffing Needs (full- and part-time faculty).

On-campus facilities: Classroom/laboratory space.

Off-campus facilities (if any).

Equipment/ Furniture: adequacy, repair needs.

Projected Major Equipment Needs (if any).

Adequacy of Library and Other Learning Resources.

Availability of Grant Funds to Augment Program/ Discipline.

Projected Program/Discipline Direction and Resource Needs.

Job Trends.

Appendix B

Survey Design Guide

1. Define the problem.
2. Conduct a literature search.
3. Prepare a list of objectives.
4. Prepare a survey budget.
5. Construct the questions.
6. Prepare the questionnaire.
7. Prepare the code book.
8. Pilot test and revise.
9. Distribute the questionnaire.
10. Code and obtain data.
11. Analyze data and write report.
12. Archive report, data, and code book for future use.

Appendix C

Computer Use Questionnaire

Engineering Technology
Computer Use Survey

Please answer each question below as it applies to your department. You may make any notes in the margin or on the back as you wish.

1. Approximately how many full-time and part-time students do you have in your associate degree engineering technology programs (please include both career and transfer students)?

	Full-time	Part-time
Electrical/Electronic Engineering Technology	_____	_____
Mechanical Engineering Technology	_____	_____
Civil Engineering Technology	_____	_____
Manufacturing Engineering Technology	_____	_____
Industrial Engineering Technology	_____	_____
Other Technology Programs	_____	_____

2. Estimate the percentage of your students who you believe have their own DOS or Windows compatible Computer.

_____%

3. Approximately how many computers are available for students to use in your department and general college facilities?

	PC-based	Mac-based
Department	_____	_____
College	_____	_____

4. How do your students acquire their PC skills (please use approximate percentages)?

On their own	____%
Before entering the college	____%
In a department level course	____%
In a general college course (outside of the department)	____%

BEST COPY AVAILABLE

5. Please circle the percentage of computers in your department that are networked.

0% 10% 25% 50% 75% 90% 100%

6. What access to the Internet does your program have (check all that apply)?

____ No access	____ Individual student accounts
____ Individual faculty accounts	____ Department accounts
____ Library access accounts	____ Other

7. Most associate degree programs are between 60 and 70 semester credit hours and consist of about 20 courses. Please estimate the number of courses (from 0 to 20) in your engineering technology programs that use PCs (or Macs) and related software.

____ (a number from 0 to 20)

8. If your program uses PC based machines, please check all software programs below to which students have access or are use in your engineering technology program.

____ AutoCAD	____ Logic Works	____ Derive
____ Microstation	____ MicroCAP III	____ Mathcad
____ VersaCAD	____ Spice	____ Matlab
____ Wordperfect	____ Electronic Workbench	____ Mathematica
____ Microsoft Word	____ Lotus 123	____ Excel
____ Novell netware	____ CA/SuperProject	____ Other

9. From the list of languages below please check all that are used in your engineering technology programs and the level of involvement.

	Not Applicable	Offered (not required)	Suggested	Required
BASIC				
Pascal				
Fortran				
C or C++				
Assembly (PC or microprocessor)				
Cobol				
Other (please list)				

10. Circle the number of ABET programs in your department.

0 1 2 3 more than 3

Thank You. Please fold, tape or staple closed and return by mail.

BEST COPY AVAILABLE

Appendix D

Cover Letter

CCAC COMMUNITY COLLEGE OF ALLEGHENY COUNTY

SOUTH CAMPUS

1750 CLAIRTON ROAD, ROUTE 885
WEST MIFFLIN, PA 15122-3097
(412) 469-1100

Dear Department Chair:

In recent years great changes have taken place in computer technology. Many of these new changes have been incorporated to support programs in engineering technology. Departments have expended large resources to provide modern computer technology to their students. But, what is the current use of computers by departments of engineering technology? Little direct information seems to exist to allow departments to compare their successes with other schools. This survey will attempt to profile the current use of computers and application software by the associate degree programs in engineering technology.

Please take a few moments to respond to the ten questions in the questionnaire. You may write any comments directly on the form. When completed, please fold the questionnaire to expose the return address and tape the flap shut. -To protect your confidentiality no specific reference is made to your school. The results will be submitted to ERIC, but if you would like a summary, please return the enclosed postcard with your name and address.

Thank you for taking the time to assist in this study. If you have any additional questions, you may contact me at the address listed above.

Sincerely,

Pearley Cunningham

Pearley Cunningham
Professor,
Department of Engineering Technology
email: pcunning@ccac.edu

Appendix E

Envelope Design

Tape closed along this edge

- -

Dept. of Engineering Technology
CCAC South Campus
West Mifflin, PA 15122

Prof. P. Cunningham
Department of Engineering Technology
Community College of Allegheny County
South Campus
1750 Clairton Rd., Rt 885 South
West Mifflin, PA 15122

- -

fold inside and tape closed

Appendix F

List of Schools

Ohio
Cincinnati Technical College
Clark Technical College
Columbus State Community College
DeVry Institute - Columbus
Hocking Technical College
Lima Technical College
Owens Technical College
Central Ohio Technical College
Shawnee State University
Sinclair Community College
Southern State Community College
Stark Technical College
University of Toledo Community and Technical College
Washington State Community College

West Virginia
Bluefield State College
Fairmont State College
West Virginia Institute of Technology

Michigan
Delta College
Henry Ford Community College
Grand Rapids Community College
Jackson Community College
Lansing Community College
Macomb Community College
Monroe Community College
Lawrence Institute of Technology
Michigan Technical University

Maryland
Anne Arundel Community College
Catonsville Community College
Montgomery College
Prince Georges Community College

Pennsylvania
Beaver Community College
Bucks Community College
Butler County Community College

Erie County Technical Institute
Harrisburg Area Community College
Spring Garden College
Northhampton County Area
Community College
Pennsylvania College of Technology
Community College of Allegheny
County
Westmoreland County Community
College

New York
Brox Community College
Broome Community College
Erie Community College
Hudson Valley Community College
Mohawk Valley Community College
Monroe Community College
Nassau Community College
Niagara Community College
New York City Technical College
Orange County Community College
Westchester Community College
Queesborough Community College
Suny Agricultural and Technical College
Morrisville and Alfred

New Jersey
Atlantic Community College
Bergen Community College
County college of Morris
Hudson Valley Community College
Mercer County Community College
Middlesex County College
Ocean County College

Illinois
Beleville Area College
Morrison Institute of Technology
Parkland College
Rock Valley College

Wisconsin
Madison Area Technical College
Lakeshore Technical College
Milwaukee Area Technical College

Massachusetts
Franklin Institute
Greenfield Community College
North Shore Community College
Springfield Technical Community College

Virginia
John Tyler Community College
Southwest Virginia Community College
Virginia Western Community College
Northern Virginia Community College

South Carolina
Florence - Darlinton Technical College
Greenville Technical College
Midlands Technical College
Piedmont Technical College
Spartanburg Technical College
Tri-County Technical College
Trident Technical College
York Technical College

North Carolina
Asheville-Buncombe Technical College
Cape Fear Technical College
Catawba Valley Technical College
Central Carolina Technical College
Central Piedmont Community College
Davidson County Community College
Fayetteville Technical Community College
Forsyth Technical Community College
Gaston College
Guilford Technical Community College
Pitt Community College
Sandhills Community College
Wake Technical Community College

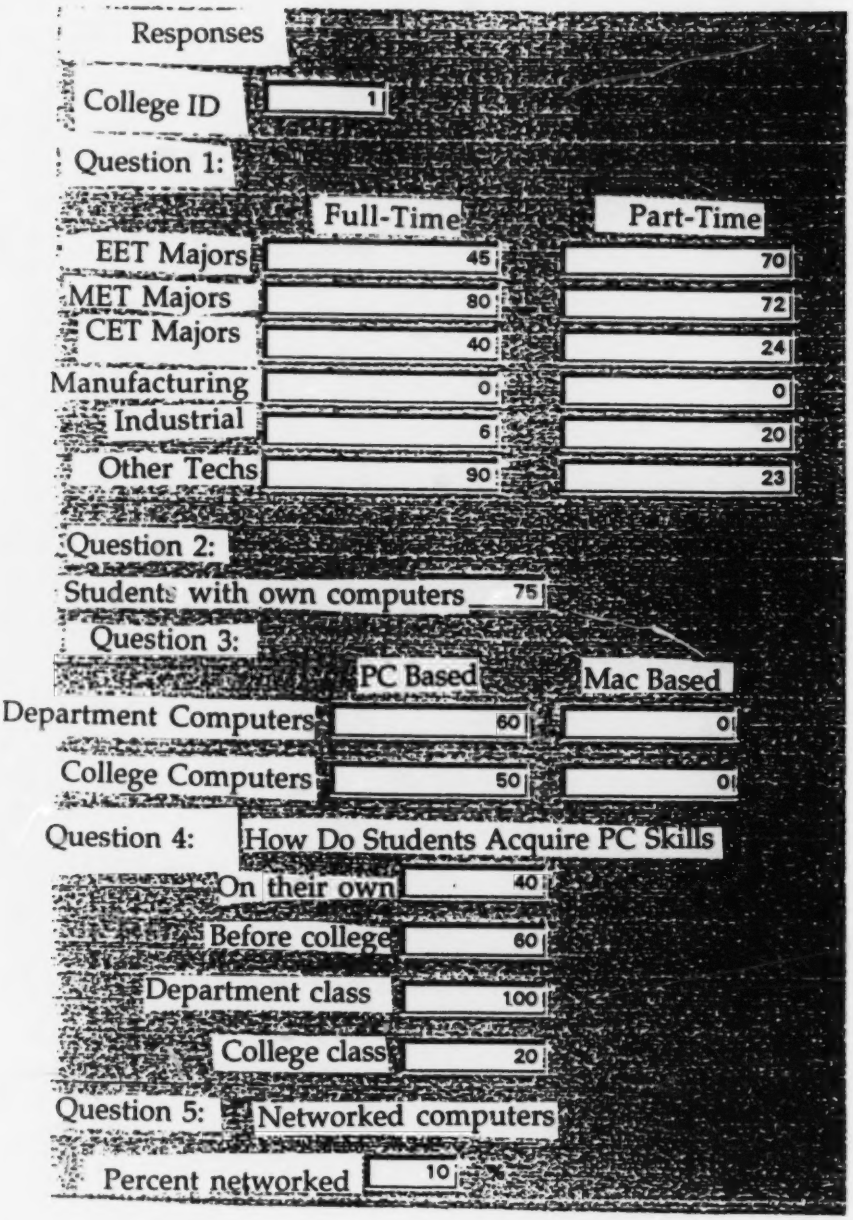
Missouri
Jefferson College
St. Louis Community College - Florissant
St. Louis Community College - Forest Park

Kentucky
University of Louisville

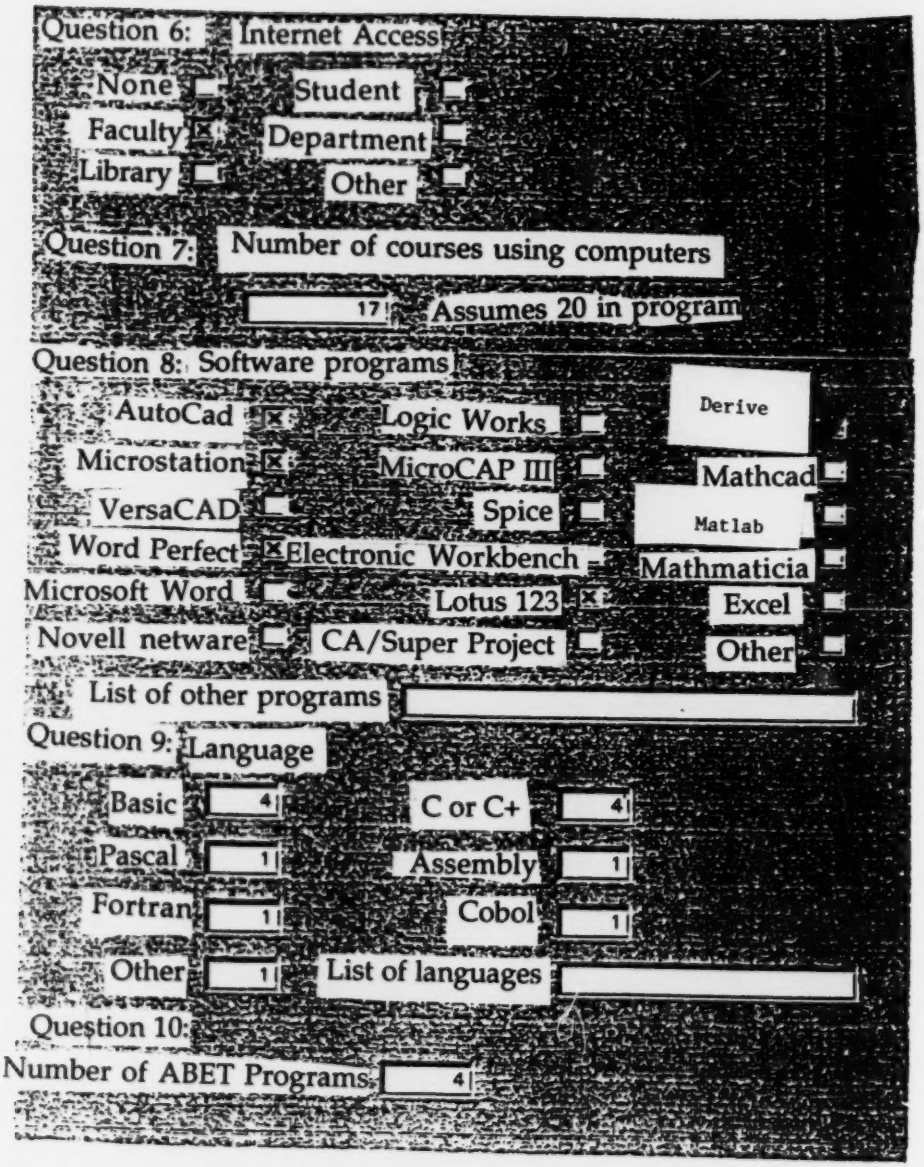
Conneticut
Bridgeport Engineering Institute
Norwalk State Technical College

Delaware
Delaware Technical Community College

Appendix G
Access Database Input Screen



BEST COPY AVAILABLE



BEST COPY AVAILABLE